

TECHNOLOGY TRANSFER OPPORTUNITY

Harsh Environment Protective Housings for Electrical and Fluid Connectors

Researchers at NASA's Kennedy Space Center have developed a novel ruggedized housing for an electrical or fluid umbilical connector that prevents intrusion of dust, sand, dirt, mud, and moisture during field use under harsh conditions. The connector housings are tough, ergonomic, simple to use, and require minimal effort to mate/demate.

The Problem

Anyone who has ever had to mate and demate electrical or fluid connectors under harsh environmental conditions is well aware of what can happen when dust, sand, dirt, mud, or moisture work their way inside the connectors. Connectors fail to seat properly, pins are bent, electrical connectivity is intermittent or nonexistent, fluids leak, and the list goes on. Accidentally dropping an unprotected connector into dirt, mud, or a puddle can render a very expensive piece of hardware virtually useless. Connectors can also be inadvertently stepped on or rolled over when lying on the floor or ground. When exposed to atmospheric moisture, cryogenic fluid connectors will instantly ice up. An effective, durable, easy-to-use protection method is needed for electrical and fluid connectors being deployed during operations in harsh environments.

The Solution

To solve this problem, NASA engineers have developed a pair of hand-sized protective umbilical interface housings, each containing a connector with an integrated end cap. When the end cap covers the connector, the connector is protected (Figure 1). Each housing has a unique lever assembly connected to the end cap that, when squeezed, flips the end cap up to expose the connector. When in the up position, the two end caps face each other. To mate the connectors, the levers on both housings are squeezed, raising the end caps, and the two umbilicals are joined and twisted to couple them. Once the connectors are mated, the levers on both housings are released. This simultaneously seals both the umbilicals and the end caps (Figure 2). When dealing

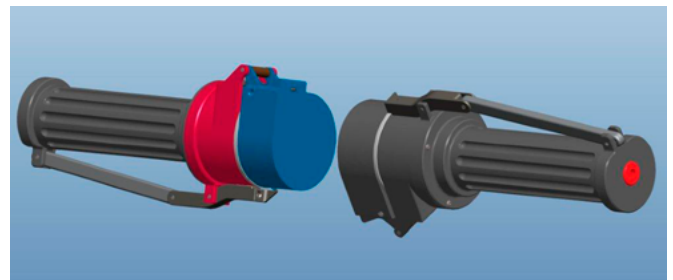


Figure 1. Demated Connectors (End Caps Down)

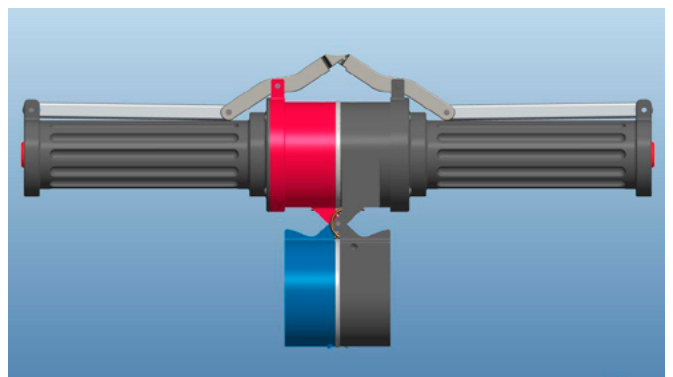


Figure 2. Mated Connectors (End Caps Up)



Benefits

- Protection – securely shields connectors from dust, dirt, mud, and moisture
- Rugged – withstands harsh environments and rough use (e.g., being dropped, stepped on, or rolled over)
- Cryogenic Fluids Transfer – housing can be purged to avoid icing when demated (e.g., liquified natural gas)
- Scalable – can be sized up or down for different-sized connectors
- Ergonomic – designed to be easily held in one hand; requires minimal pressure to open and close
- Modular – any COTS connector can be installed and swapped in a modular, universal housing

Applications

- Military operations
- Space operations
- Desert operations
- Mining operations
- Oil field and refinery operations
- Cryogenic fluids transfer (liquified natural gas [LNG], nitrogen, oxygen, hydrogen)

with cryogenic connectors, a purge can be applied to the housings to prevent icing when the connectors are demated.

Technology Advantages

These connectors are designed to be used in harsh environments and to withstand rough handling, such as being stepped on or rolled over by wheelbarrows or light vehicles. If the demated connectors are dropped or placed on the ground, the end caps will shield them from damage and contaminants. When mated, the seal between the housings and end caps keeps contaminants out. The end caps are latched to the housings so that the caps cannot be unintentionally opened; this latch can be opened only by depressing the levers. The spring used to open or close the cap is constructed of a shape memory alloy, allowing the cap to be opened and closed an almost infinite number of times. The cap actuation levers are designed so that only a 3/4-inch pull is needed to open the cap a full 190 degrees. The housings can accept most commercial-off-the-shelf electrical or fluid connectors (including those designed for cryogenics), thus eliminating the need for specialized connectors in hostile environments. The housings can also be grounded and scaled up or down to accommodate connectors of different sizes. The housings can be constructed of steel, aluminum, composites, or even plastic, depending on the environment in which they will be used and material cost constraints.

Licensing Opportunities

NASA's Kennedy Space Center is offering the opportunity to license and commercialize this innovative technology. If your company is interested in the Harsh Environment Electrical and Fluid Connectors technology, please make reference to Case Number KSC-13457 and contact:

Lew Parrish
Technology Transfer Office
Mail Code: ESC-22
Kennedy Space Center, FL 32899
Telephone: (321) 867-5033
Fax: (321) 867-2050
Lewis.M.Parrish@nasa.gov
Website: <http://technology.ksc.nasa.gov>

National Aeronautics and Space Administration

John F. Kennedy Space Center
Kennedy Space Center, FL 32899
www.nasa.gov/centers/kennedy

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